

FCC ID: 2A3DJ-Q9

Maximum Permissible Exposure (MPE)

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

BT:

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/ cm²

Antenna Type: PCB antenna

BT antenna gain: -0.58 dBi ;

R=20cm

antenna gain Numeric = $10^{(dBm/10)} = 10^{(-0.58/10)} = 0.87$

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	-0.566	0±1	1	1.259	-0.58	0.87	0.0002	1
2441		1.168	1±1	2	1.585	-0.58	0.87	0.0003	1
2480		1.336	1±1	2	1.585	-0.58	0.87	0.0003	1
2402	π/4-DQPSK	0.179	0±1	1	1.259	-0.58	0.87	0.0002	1
2441		0.43	0±1	1	1.259	-0.58	0.87	0.0002	1
2480		0.27	0±1	1	1.259	-0.58	0.87	0.0002	1
2402	8-DPSK	0.671	0±1	1	1.259	-0.58	0.87	0.0002	1
2441		0.806	0±1	1	1.259	-0.58	0.87	0.0002	1
2480		0.727	0±1	1	1.259	-0.58	0.87	0.0002	1
2402	BLE(1M)	-4.955	-4±1	-3	0.501	-0.58	0.87	0.0001	1
2440		-3.228	-4±1	-3	0.501	-0.58	0.87	0.0001	1
2480		-3.209	-4±1	-3	0.501	-0.58	0.87	0.0001	1
2402	BLE(2M)	-5.221	-5±1	-4	0.398	-0.58	0.87	0.0001	1
2440		-3.566	-3±1	-2	0.631	-0.58	0.87	0.0001	1
2480		-3.377	-3±1	-2	0.631	-0.58	0.87	0.0001	1

WIFI:

Operation Frequency: 2.4g WIFI 802.11b/g/n HT20: 2412-2462MHz,
 5.2gWIFI 802.11a/n(HT20): 5180-5240MHz
 WIFI 802.11n(HT40): 5190-5230MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPC Antenna

Antenna gain: 2dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2/10)}=1.58$

2.4g WIFI

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	2412	802.11b	15.95	16±1	17	50.119	2.00	1.58	0.0158	1
Ant 1	2437		16.47	16±1	17	50.119	2.00	1.58	0.0158	1
Ant 1	2462		16.37	16±1	17	50.119	2.00	1.58	0.0158	1
Ant 1	2412	802.11g	12.74	12±1	13	19.953	2.00	1.58	0.0063	1
Ant 1	2437		12.59	12±1	13	19.953	2.00	1.58	0.0063	1
Ant 1	2456		12.53	12±1	13	19.953	2.00	1.58	0.0063	1
Ant 1	2412	802.11n H20	10.68	11±1	12	15.849	2.00	1.58	0.0050	1
Ant 1	2437		11.28	11±1	12	15.849	2.00	1.58	0.0050	1
Ant 1	2462		11.41	11±1	12	15.849	2.00	1.58	0.0050	1
Ant 1	2422	802.11n H40	10.14	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	2437		10.21	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	2452		10.41	10±1	11	12.589	2.00	1.58	0.0040	1

5.2g WIFI

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	5180	802.11a	11.2	11±1	12	15.849	2.00	1.58	0.0050	1
Ant 1	5200		10.63	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	5240		10	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	5180	802.11n H20	10	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	5200		11.07	11±1	12	15.849	2.00	1.58	0.0050	1
Ant 1	5240		10.02	10±1	11	12.589	2.00	1.58	0.0040	1
Ant 1	5190	802.11n H40	9.8	9±1	10	10.000	2.00	1.58	0.0032	1
Ant 1	5230		9.92	9±1	10	10.000	2.00	1.58	0.0032	1

Note: This product does not support simultaneous transmission.

The conclusion should be $0.0063 < 1$ for Max Power Density, Compliance the RF Exposure requirement.

Signature:

Date: 2022-07-29



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